Turbosound®

TSE Series Users Manual

TSE SERIES USERS MANUAL

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UNPACKING

As part of our system of quality control, every Turbosound product is carefully inspected before packing to ensure flawless appearance. After unpacking your enclosure, please inspect for any physical damage, and save the shipping carton and all relevant packing materials in case the unit again requires packing and shipping. In the event that damage has been sustained, notify your dealer immediately so that a written claim to cover the damages can be initiated.

WARRANTY

This enclosure is warranted by Turbosound to the original purchaser, against defects in workmanship or faulty materials used in manufacture, for a period of two years from the date of shipment. Faults due to purchaser misuse, unauthorised modifications or accidents, are not covered by this warranty. No other warranty is expressed or implied.

In the unlikely event that your unit is faulty, it should be sent, shipping prepaid, to an Authorised Dealer, or direct to Turbosound, stating the faults as found. The serial number must be quoted in any correspondence relating to this warranty.

INTRODUCTION

Thank you for purchasing a Turbosound system.

Over the last few years, there has been an ever-increasing awareness of the availability of high quality sound (F.M. car radios, compact discs). Concert and theatre-goers and indeed audiences in general at all types of functions where music or speech is involved, are coming to expect a high quality of sound reproduction.

At Turbosound we have always felt that the audio quality of a high power sound system must be such that the system becomes "transparent" and does not detract from the quality of a performance. Indeed, the performer's abilities should be augmented by the facility to reach larger audiences whilst maintaining the intimate psycho acoustic quality of closeness to the stage. There are a number of factors inherent in the design of Turbosound enclosures that allow the system designer to maximise this approach to sound reinforcement.

Turbosound sound reinforcement products include a number of unique, patented features which enable these enclosures to offer a combination of high-power capability with extremely low distortion, exceptional frequency response and transient-handling, in unusually compact enclosures.

To make the best use of these capabilities, the system must be operated correctly. The intention of this user manual, therefore, is to indicate system considerations which will enable you to maximise the performance of your Turbosound product.

If you have any questions which are not covered in this manual, or you have observations which you feel would be useful to other Turbosound users, please contact your dealer.

OVERVIEW

Your Turbosound enclosures are only one link in the chain which forms the entire system. Each of the links in that chain must reach the same, high standard, and should complement the standards of the enclosure.

Two fundamental concepts should be borne in mind when setting up a Turbosound system:

Firstly, Turbosound units are basically of the "point and shoot" variety, offering carefully-tailored dispersion characteristics. Whilst bearing in mind the fact that adjacent enclosures will influence each other, the idea of aiming the cabinets more-or-less where the sound is required to go, will provide a good starting point for the setting-up of these enclosures.

Secondly, Turbosound systems do have some unconventional qualities which set them apart from ordinary loudspeakers. Although this manual advises the use of various test instruments, listening to the system (i.e. using your ears!) is probably the best final assessment.

AMPLIFICATION & SYSTEM PROTECTION

All Turbosound enclosures should be driven by professional-quality amplifiers capable of providing a full 3dB of headroom when operating at high levels, to preserve the transient response of the enclosure. An amplifier with insufficient drive capability will not allow the full performance of the unit to be realised.

It is difficult to overdrive a Turbosound enclosure, and within reasonable limits the recommended amplifier power can be exceeded without fear of damaging the units. However, damage will certainly be sustained if the amplifier is driven into clip for any extended period of time.

FIG 1

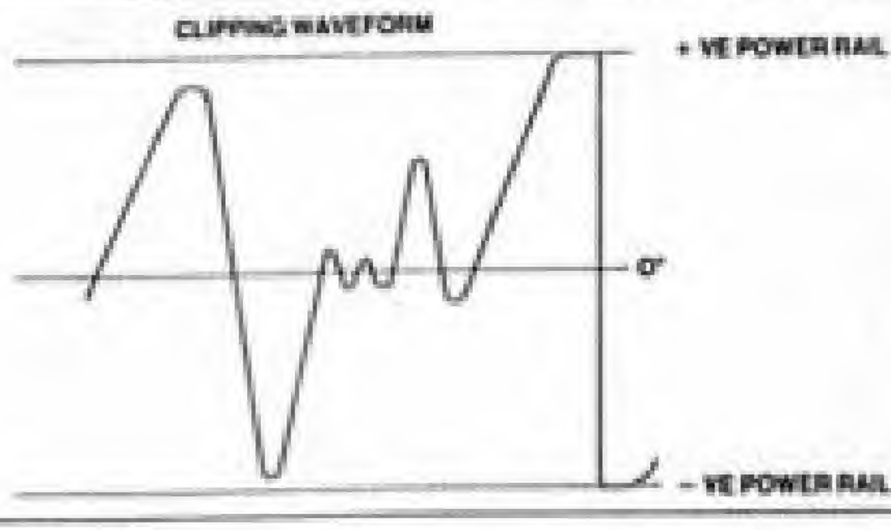


Figure 1 shows clipping caused by overdriving the amplifier. If this clipped signal is fed to a loudspeaker, it will not only detract from the sound quality, but may cause permanent damage (clipped wave forms are like short bursts of D.C. and tend to heat up the speaker voice coil by driving it out of the magnet gap). Some amplifiers have "soft clip" characteristics which round off the edges of clipped wave forms. However, a limiter or crossover with limiting built in will stop amplifier clipping and ensure a long life from your enclosures.

Note: Limiters must be adjusted to suit amplifier sensitivity. Refer to limiter or crossover manufacturers' literature.
The amplifier requirements for the TSE Series are as follows:

TSE-260

The TSE-260 high frequency enclosure is passive and should be driven by a professional-quality amplifier capable of supplying 100 watts RMS continuously into a 16 ohm load.

TSE-111

The TSE-111 mid/high enclosure is passive 2-way and should be driven by a professional-quality amplifier capable of supplying 150 watts RMS continuously into a 16 ohm load.

TSE-211

The TSE-211 mid/high enclosure is bi-amped/passive 2-way and should be driven by professional-quality amplifiers capable of performing as follows:

Driver section	Amp power (RMS Watts)	Impedence (Ohms)
Mid	200	8
High	100	8
Passive	300	4

TSE-115

The TSE-115 bass enclosure should be driven by a professional-quality amplifier capable of supplying 250 watts RMS continuously into an 8 ohm load.

TSE-215

The TSE-215 bass enclosure should be driven by a professional-quality amplifier capable of supplying 500 watts RMS continuously into a 4 ohm load.

TSE-118

The TSE-118 bass enclosure should be driven by a professional-quality amplifier capable of supplying 300 watts RMS continuously into an 8 ohm load.

TSE-218

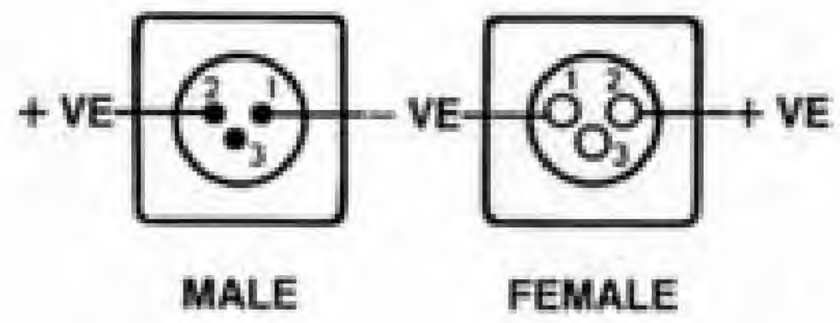
The TSE-218 bass enclosure should be driven by a professional-quality amplifier capable of supplying 600 watts RMS continuously into a 4 ohm load.

CABLING

The recommended wire size for the majority of applications is 2.5 sq. mm (12 gauge). This will be perfectly satisfactory under normal conditions. For reference, acceptable performance will be obtained with an absolute minimum of 1.5 sq. mm (14 gauge), assuming that the amplifiers are in close proximity to the speakers. In the case of runs in excess of 100 feet or so, the wire size should exceed this. See following table for further information.

CABLE RUN IN METRES	CROSS SECTIONAL AREA OF EACH CONDUCTOR (mm)	CABLE RESISTANCE IN OHMS	GUIDE TO PERCENTAGE POWER LOSS INTO 8Ω LOAD (%)	PERCENTAGE POWER LOSS INTO 4Ω LOAD (%)
2·5	1·0	0·086	1·1	2·2
	1·5	0·058	0·73	1·5
	2·0	0·043	0·54	1.1
	2·5	0·035	0·44	0·09
	4·0	0·021	0·20	0·55
5	1·0	0·173	2·2	4.3
	1·5	0·115	1·4	2·9
	2·0	0·086	1·1	2·2
	2·5	0·069	0·86	1·7
	4·0	0·043	0·54	1·1
10	1·5	0·230	2·9	5·8
	2·0	0·173	2·2	4·3
	2·5	0·136	1·7	3·5
	4·0	0·086	1·1	2·2
	6·0	0·058	0·73	1·5
25	1·5	0·575	7·2	14·0
	2·0	0·431	5·4	11·0
	2·5	0·345	4·3	8·6
	4·0	0·216	2·7	5·4
	6·0	0·144	1·8	3·6
50	2·0	0·863	11·0	22·0
	2·5	0·690	8·6	17·0
	4·0	0·431	5·4	11·0
	6·0	0·288	3·6	7·2
	10·0	0·173	2·2	4·3
100	2·0	1·73	22·0	43·0
	2·5	1·38	17·0	35·0
	4·0	0·863	11·0	22·0
	6·0	0.575	7·2	14·0
	10·0	0·345	4·3	8·6

FIG 2



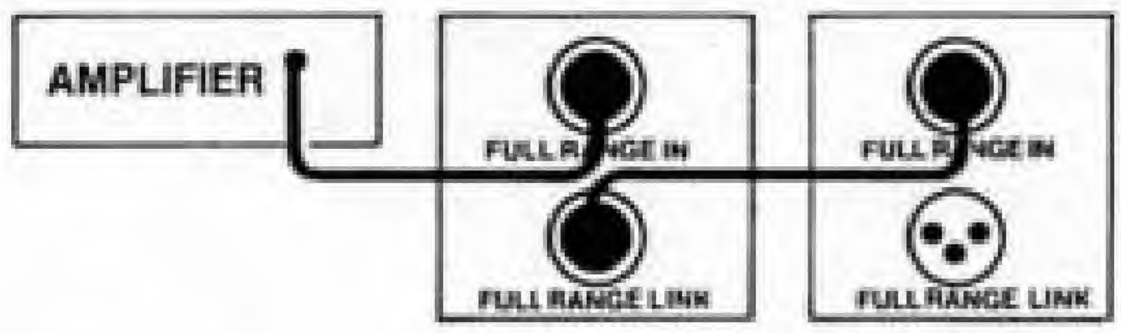
CONNECTIONS

There is a great deal of controversy as to the "correct" wiring of XLR-type connectors, especially when they are used for amplifier output applications - several wiring conventions are used. Turbosound have followed the method most commonly found in the sound reinforcement industry internationally, but special care should be given to this area. See Figure 2.

The connectors are wired as follows:

Pin	Name	Polarity	Colour
1	Ground/Common	-	Black/Blue
2	Hot	+	Red/Brown
3	Not connected	N/A	N/A

FIG 3



TSE-260

The TSE-260 is a switchable active/passive high frequency enclosure and is fitted with two 3-pin XLR-type connectors.

TSE-111

The TSE-111 is a passive, 2-way, mid/high system.

The enclosure is fitted with two 3-pin XLR-type connectors, one male and one female.

TSE-211

The TSE-211 mid/high enclosure is switchable bi-amped/passive 2-way and is fitted with four 3-pin XLR-type connectors.

TSE-115, TSE-215, TSE-118 and TSE-218

The TSE-115, TSE-215, TSE-118 and TSE-218 are bass enclosures.
The enclosures are fitted with two 3-pin XLR-type connectors, one male and one female.

NB In all cases the male and female connectors are wired in parallel, so that either may be used as the input to the cabinet, the second then being available for "daisy-chaining" to a second enclosure. See Figure 3.

CROSSOVERS

A 24dB/octave two-way active crossover is required if the TSE-111 is to be used in conjunction with a bass enclosure such as the TSE-118 or TSE-218 or vice versa. Ideally, the crossover should have the capability to invert the polarity of each band. The recommended crossover point is 250 Hz.

It should be noted that the TSE-111 is wired internally 180 degrees out of phase with respect to the TSE-118 and TSE-218. Experience has shown that this gives the best response with the majority of crossovers.

If ultra-low frequency projection is desired, a sub-woofer enclosure may be added, e.g. the Turbosound TSW-124. In this case, a three-way active crossover is needed, with crossover points set at 80Hz and 250Hz.

N.B. In the case of the TSE-115/215/118/218, the sub-bass filter may be a low pass type and the 15" or 18" units can be allowed to go down to 30Hz. In this case the use of a 24dB/octave crossover incorporating phase correction is advisable. (see chapter on PHASE ALIGNMENT)

EQUALISATION

An important point to remember with Turbosound enclosures is that they are designed to need no equalisation or correction to overcome system limitations. As a result, they will require equalisation to compensate only for aspects of the acoustic environment.

Over-equalisation introduces phase distortion and can reduce system headroom, causing more problems than it cures. EQ should be applied gently and smoothly, and a 1/3 or 1/2 octave graphic equaliser will generally be quite sufficient. Turbosound enclosures are phase-coherent designs, and violent equalisation will be detrimental to the overall sound quality.

POLARITY CHECKING

All Turbosound units are shipped wired as stated above. However, with a number of different types of amplifier and wiring runs used in many systems, polarity inconsistencies may be created.

There are two basic methods of checking that the polarity of the system is correct. You can use either, or both methods.

The first method utilises a third-octave analyser and pink noise generator.

With the loudspeaker set up correctly, as far as is known, feed the pink noise signal into the system and adjust to a suitable level for measurement. Place the measurement microphone a few feet in front of, and on axis between the TSE-111 and any Bass enclosure that may be being used. Switching the crossover sections 180 degrees in and out of phase (i.e. reversing the polarity) will reveal a distinct dip in the response at the crossover frequency when inverted, and a smooth, essentially flat response when correct.

In the case of a multiple array, disconnect all but one of the enclosures. With the first loudspeaker set up correctly as above, feed the pink noise signal into the Bass section of the system (if being used). Place the measurement microphone a few feet in front of, and on axis between, the Bass sections of the first cabinet and the adjacent unit in the array. Now connect the adjacent unit. The analyser display should jump up in level. This indicates that the two Bass sections are correctly connected with respect to each other. If they are INCORRECTLY connected, there will be a good deal of cancellation. Proceed along the array, moving the microphone to a point on axis between the last tested unit and the next in the array, until all Bass sections have been checked. Repeat this process with the TSE-111 Mid/High sections.

If an analyser is not available, boosting at the crossover frequency (for example, with a graphic equaliser) will make cancellation and addition effects quite audible.

The second method is to use a pulse-based polarity checking device, such as the Turbosound TPC-1151. This consists of a pulse generator (PG-11) that can be fed into the system, and a pulse detector (PD-51) which is used to monitor the polarity of the elements of the system.

Individual cabinets should be checked before setting up, and the complete system checked for overall polarity coherence after assembly. When using a phase-checker, bear in mind that meaningful results will be obtained only by comparing the same frequency section of the different units.

When checking TSE Series cabinets with the TPC-1151 or similar, its "acoustic polarity" should be as follows:

	Bass	Mid	High
TSE-260	N/A	N/A	Negative (-)
TSE-111	N/A	Negative (-)	Negative (-)
TSE-211	N/A	Negative (-)	Negative (-)
TSE-115	Positive (+)	N/A	N/A
TSE-215	Positive (+)	N/A	N/A
TSE-118	Positive (+)	N/A	N/A
TSE-218	Positive (+)	N/A	N/A

Please note: These are relative values only and do not relate to the absolute phase of the system, so they may be in reverse order.

The complete system can be tested by checking that the same driver sections of adjacent cabinets have identical polarity.

If there appear to be problems, check the cable wiring in the first instance. Also bear in mind that different manufacturers use different pin configurations and polarity conventions; if you are using amplifiers from more than one manufacturer, check the polarity at the amplifiers as well as the cabinets.

It should be noted that correctly-configured cabinets in a multiple array will load one another: if one or more cabinets are connected with the wrong polarity, they may damage the system if the mistake is not discovered. In addition, the system will not, of course, give its best performance.

PHASE ALIGNMENT

In order to assist in obtaining accurate acoustical summation of the signals from adjacent speaker units in a loudspeaker system, (e.g. between a TSE-111 and a TSE-118 or TSE-218 bass enclosure, or a sub-woofer system), it is desirable to be able to adjust the phase of the signal from one frequency band to that of the next frequency band. To facilitate these adjustments, an electronic crossover with a phase correction system will be required. This will properly allow for any phase errors that may occur between the positions of the cabinets themselves.

OPERATION & APPLICATIONS

In the past, it has often been the case that an enclosure may sound good on its own, but as soon as two or more are placed next to each other to increase the dispersion, available power handling or SPL, the tonal balance changes, usually to the detriment of the sound. Patterns of sound waves leaving adjacent components interact to produce comb filtering (see Figure 4), when the listener moves off the axis of the array. These effects are most noticable in the mid and high frequencies so crucial to the perceived sound image.

FIG 4

PROBLEMS ASSOCIATED WITH LOW DIRECTIVITY SOUND SOURCES

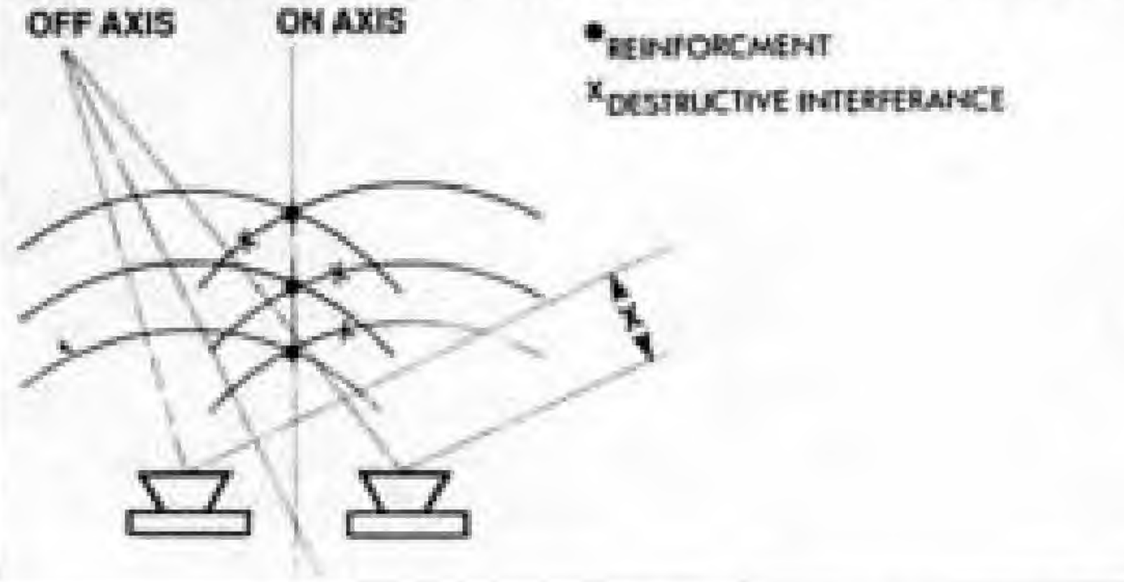
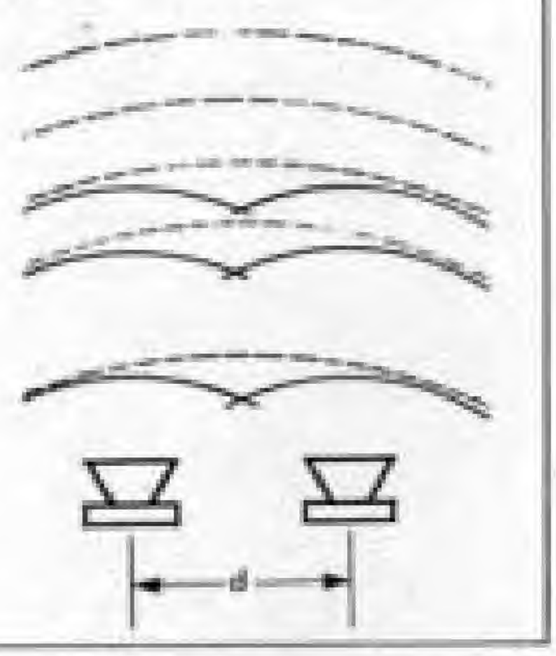


FIG 5



In the lower frequencies however, wave lengths are long enough to produce coupling, and adjacent enclosures positively reinforce each other to give substantial gains in directivity and projection (see Figure 5).

The gradual increase in directivity with rising frequency inherant in all Turbosound designs is a very positive benefit. When a system is arrayed in order to cover more than the nominal dispersion available from one enclosure, although the bass and low mid frequencies reinforce each other, in the crucial upper-mid and highs, there is limited coupling but greater inherant

projection from the individual units. This gives the listener an impression, even with large systems, that there is just one speaker. This is the real benefit of point source theory when applied to high directivity components.

As can be seen from Figure 4, the two speakers only really add at all frequencies when the listener is on axis. Off axis, the frequency at which 'x' is half a wavelength, will be cancelled along with its harmonics, in varying amounts. This is a "comb filtering" type effect.

Where wavelength is substantially longer than 'd' (see Figure 5), directivity and projection are increased without "combing".

Efforts have been made by other speaker designers to solve these problems with compression drivers on constant directivity horns. But none can be used at high levels in the mid band or "vocal range" without severe distortion. The consequent unnatural sound quality and listening fatigue that results can be extremely aggravating and even painful to the listener.

At Turbosound we believe that distortion, not SPL, produces listening fatigue and poor intelligability. For this reason the TurboMid™ device was designed to replace compression drivers in the mid-range. By relying on, compression devices only in the higher frequencies they are then subject to less stress and become both sweeter sounding and more reliable.

Furthermore, the substantially plane wavefront generated by Turbosound enclosures means that there is less attenuation with distance. Put simply, the same sound quality is available to the listener whether located at the front or the back of the auditorium. Less stray sound is reflected from walls and ceiling, and equalisation for room reflections is minimised.

Turbosound enciosures are particularly effective in an array configuration, and the cabinets are designed to offer the system designer maximum flexibility as regards both stacking and flying.

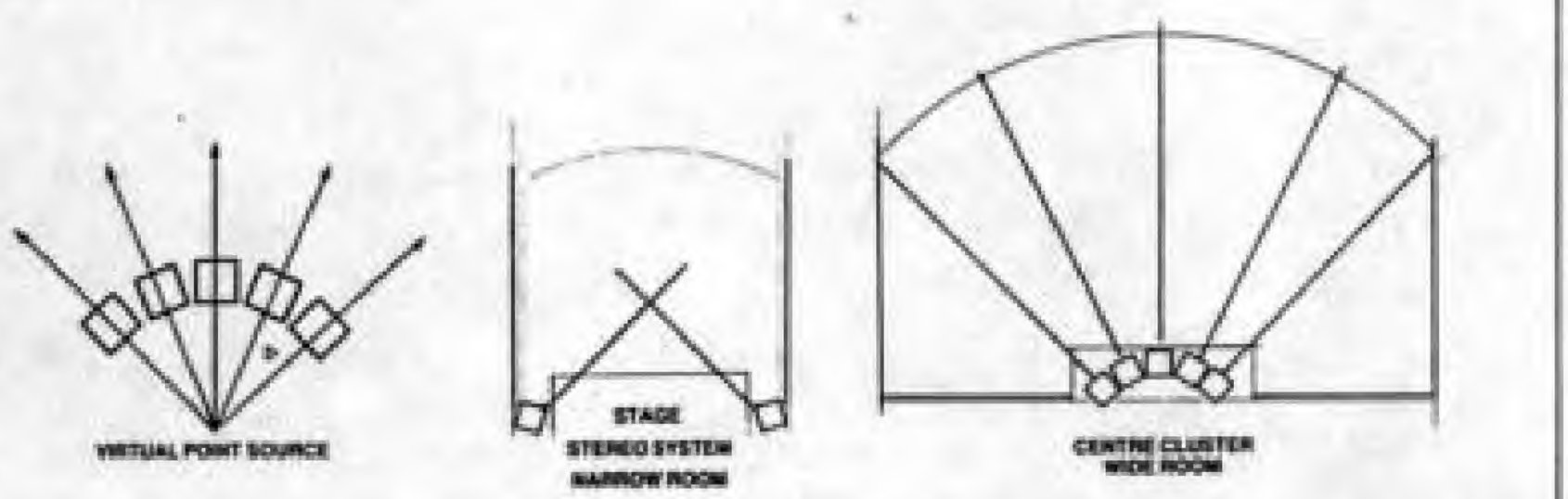
The key to successful array configurations is to bear in mind that all TSE Series high and mid/high enclosures have highly directional dispersion characteristics. This minimises HF interference effects and contributes to an even frequency distribution throughout the area to be covered.

This carefully tailored directional response enables a properly set-up system to present a virtual point source

behind the array. The secret is to ensure that no two cabinets are in the same plane. Turbosound enclosures should be splayed both horizontally and vertically in order to achieve the best results.

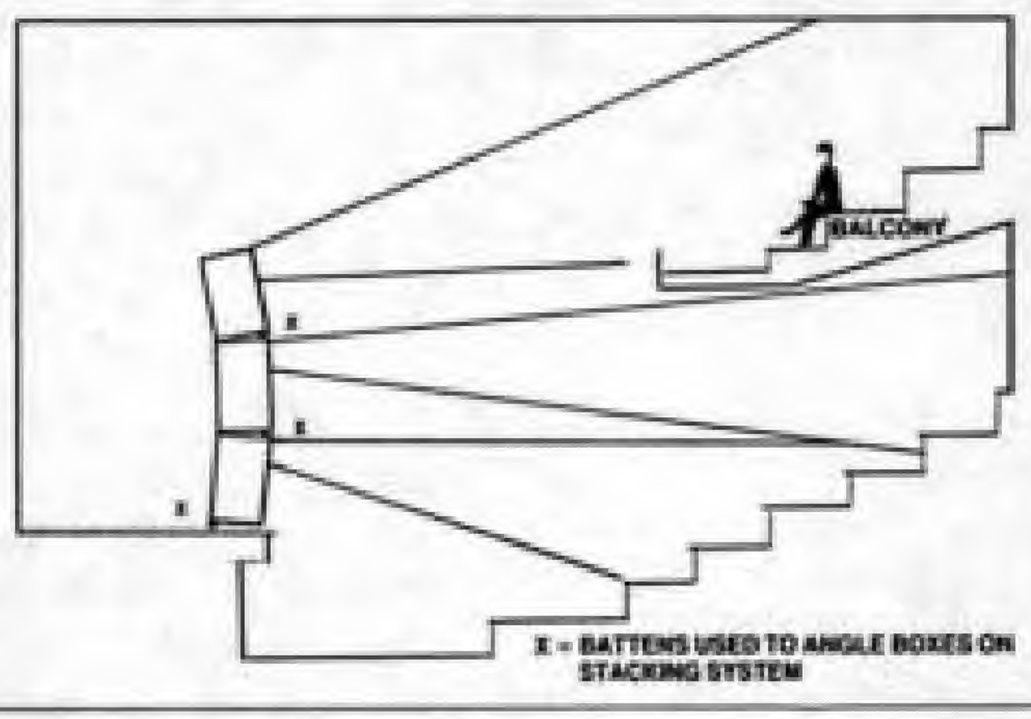
In horizontal and vertical planes, the enclosures should be splayed to form a fan. See Figure 6.

FIG 6



Δ = 10-30^{o} optimum, depending on projection required. For high power or outdoor shows, the angle could be less.

FIG 7



In stacked systems, vertical angle accuracy can be ensured by using battens between adjacent cabinets (See Figure 7). To maintain phase coherency, the rear edges of the enclosures should touch each other, so as to create a virtual point source.

TSE FLYING SYSTEM

The TSE-260, TSE-111, TSE-211, TSE-115, TSE-215 and TSE-118 make up a very versatile system and can be flown in a multitude of different configurations. The TSE-218 is designed to be floor mounted only.

Turbosound produce a separate support mechanism to place the TSE-111 at the optimum height or distance from the TSE-118 or TSE-218 Bass enclosures, for efficient operation.

The PA-111 is a specially constructed pole assembly designed to mount the TSE-111 above the TSE-118 or TSE-218, to form a stand-alone floor mounted full-range system. The PA-111 mounts directly into a recepticle

which can be fitted to the TSE-118 or TSE-218 and places the TSE-111 at 1830 mm (72 inches) above the ground.

All TSE high, mid/high and bass enclosures (with the exception of the TSE-218) can be fitted with flying frames for use with other components of the TSE Installation System. These frames provide the installer with the most comprehensive and flexible flying system available. This system can be used in a variety of configurations.

The flying frame is fitted by placing the enclosure face-down on a suitable protective surface (e.g. carpet or rubber mat) sliding the flying frame over and locating it with the bolts and locking washers supplied in the kit.

These should of course be tightened with the correct spanner and never left "finger tight".

In the four corners of the flying frame are lifting eyes to allow suspension of the enclosure.

FIG 8

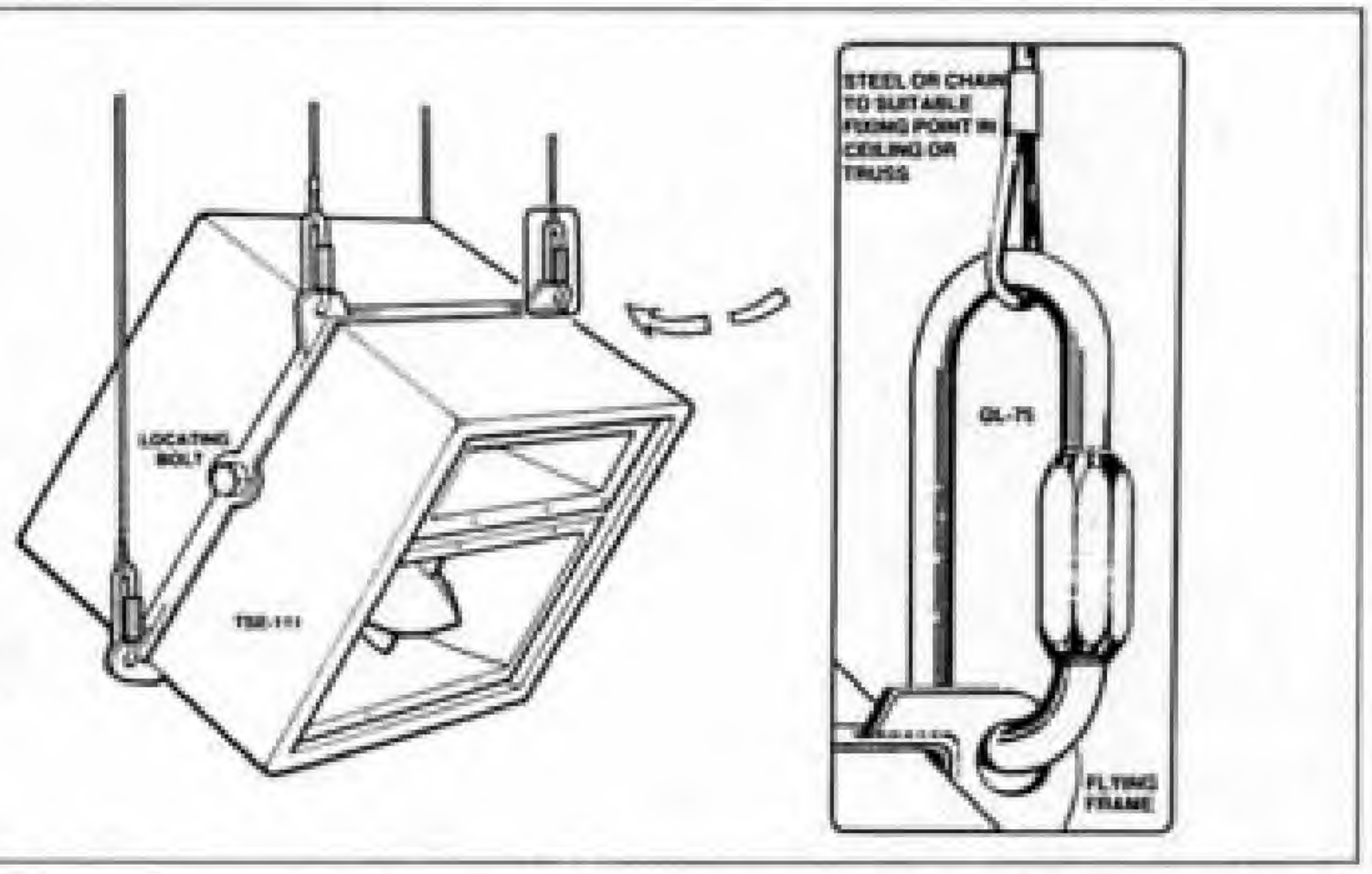


Figure 8 shows TSE-111 flown using FF-111 for typical club application. Bass enclosures could be positioned at floor level or incorporated in decor.

The dimensions and layout of the flying frame lifting eyes are shown on pages 20-23

It will be noted that a TSE-111 may be flown underneath a TSE-118 (or vice versa) using two quick-links effectively making a full range system.

In addition, if more vertical and less horizontal coverage is required, the TSE-111 may be turned through 90o, since its lifting eyes are positioned in a perfect square.

Both TSE-111 and TSE-118 units may of course be flown inverted if neccesary.

Since the flying frames join to each other, the load is transferred from frame to frame, rather than box to box, meaning that TSE systems may be "chained" together to form vertical arrays using quick-links to join them together.

FIG 9

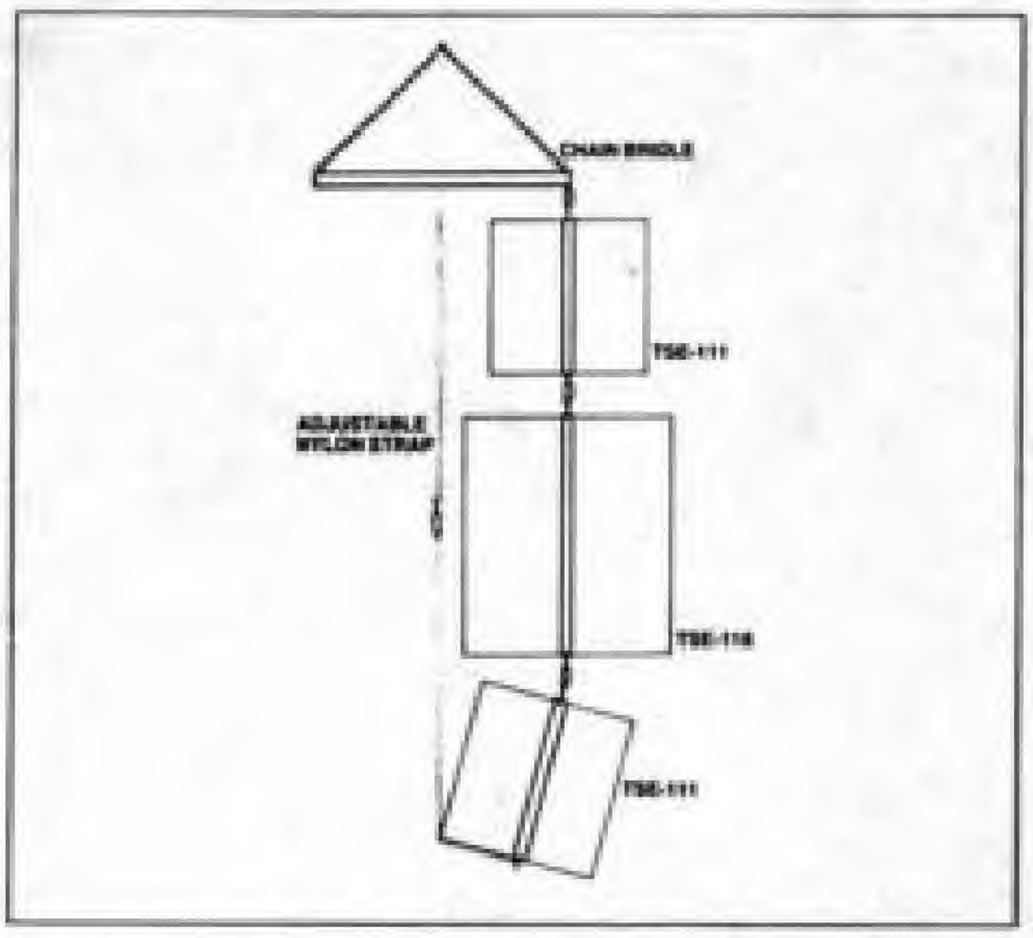


Figure 9 shows a simple flown system of 2 x TSE-111 and 1 x TSE-118 to cover a typical floor and balcony situation.

Where more horizontal coverage is needed, these arrays may be flown side by side in a curve. For this purpose Turbosound have designed the TSE flybar system which is available in 90o sections (part no. FB-90) which may be bolted together as required to suit the individual system requirements.

FIG 10

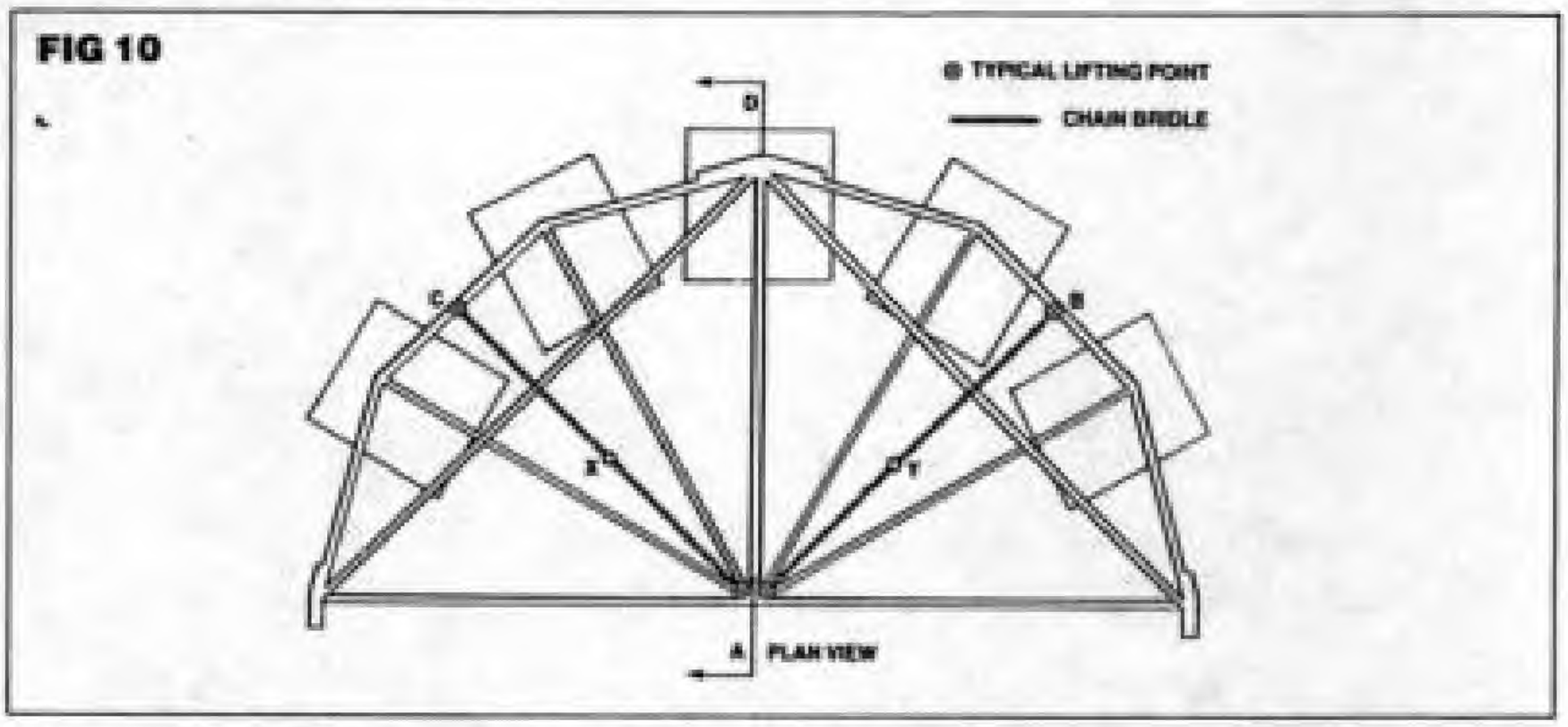
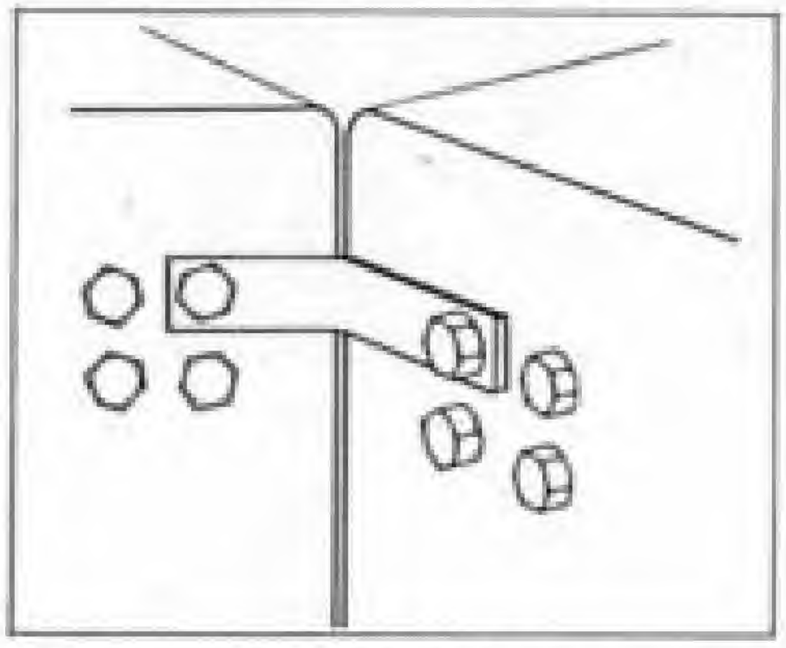


Figure 10 shows a plan view of a 180o TSE flybar (part no. FB-180c) suspending five columns of TSE enclosures. The system is flown using 2 chain bridles (part no. CB-3) at A-B and A-C and is lifted at X and Y. The length of the bridle legs is adjustable, to allow for varying weight distribution, using chokes.

Figure 11 shows the enclosures having an included angle of 30o between vertical columns. This is the recommended angle for TSE clusters using TSE-111 enclosures flown in the normal (upright) mode. Flying hardware can, however, be built to customer order.

Arrays of up to 12 columns may be configured using this flying system covering up to 360o horizontal dispersion.

FIG 11



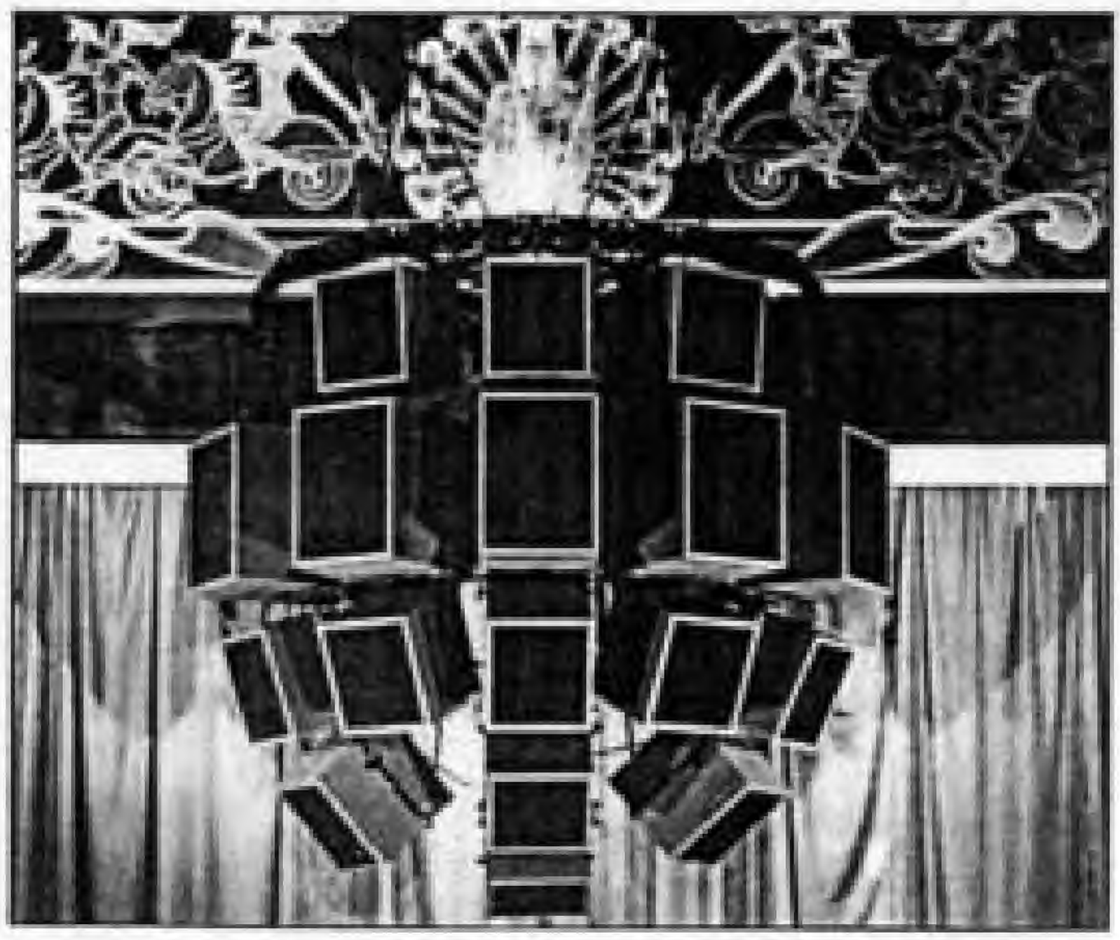
Assembling a TSE installation system is very straightforward.

After first bolting the flybar together it should be suspended from chain motors or wire hoists at about waist height. A row of quicklinks are then looped into the lugs on the flybar, nut uppermost and gate facing the assembler. The first row of enclosures can then be offered up to these, one at a time, until the row is complete. The quicklink gates are screwed shut, the cluster raised and the process repeated until all enclosures are correctly positioned.

Figure 12 shows the five-wide cluster configured for balcony and floor coverage at Portsmouth Guildhall. The brief included 100o vertical coverage and an extra row of three TSE-111's was flown at the bottom of the array to fulfill this purpose, tilted using the adjustable nylon straps (part no's. TS-6 or TS-10).

Individual enclosures should be adjusted for level at the amplifiers.

FIG 12



GLOSSARY

AMPLITUDE - Refers to the voltage level or intensity of a signal, and is usualy measured in volts or decibels.

COMB FILTERING - The additive and subtractive interferance between multiple sound sources of low directivity

DAMPING FACTOR - Tendency of amplifier to exert control over speaker, preventing overshoot and spurious resonance. Higher damping factors don't necessarily sound better. It's always best to keep speaker cables as short as possible or the system will tend to sound "loose" and ill defined. (see chart in CABLING section)

dB - A unit for expressing the ratio between two signal levels for comparison purposes. On its own it has no "absolute" level and is used for logarithmic scaling e.g. you have to be aware of the mean point of measurement. Positive numbers indicate an increase and negative ones a decrease. Some useful ratios are:

3dB = double power
6dB = double amplitude or quadruple power
10dB = triple amplitude or ten times power
20dB = ten times amplitude or hundred times power

DISTORTION - Refers to any modification of a signal which produces new frequency components not present in the original. Harmonic distortion refers to added frequencies that are overtones to the fundamental frequency. Intermodulation distortion refers to added frequencies that are sum and difference values derived from the beating together of two frequencies.

EQUALISATION - Modification of the frequency response of an audio system, regardless of level, for corrctive or enhancement purposes.

FREQUENCY - The repetition rate of a waveform. The unit of frequency is Hz, and 1 cycle per second is equal to 1 Hz. The audio band is generally restricted to frequencies of 20 Hz to 20,000 Hz (20 - 20 kHz).

FREQUENCY RESPONSE - Refers to the relative gain of circuits at all-frequencies across its usable band. Generally expressed as +/- a certain number of dBs from 20 Hz to 20 KHz.

HEADROOM - The amount, in dBs, above normal operating level that can be used before serious distortion commences.

IMPEDANCE - The AC equivalent of resistance and measured in ohms. It indicates the drive capability of an output, or the amount of drive required for an imput, at any given signal level.

LEVEL - The amplitude of a signal, measured in volts or decibels.

OCTAVE - A logarithmic unit for expressing frequency ratios. Positive values indicate an increase in frequency and negative ones a decrease. One octave is equivalent to double or half frequency.

PLANE WAVEFRONT - Theoretically, a completely plane wavefront device would have zero dispersion and infinite projection.

PSYCHO ACOUSTICS - The subjective effects of sound on the mind of the listener.

SOUND IMAGE - This refers to the imagined perspectives of a sound source. For example, with your eyes closed a voice should sound human and as though it is coming from a particular point. If it doesn't, the system is likely to be badly set up. High directivity usually brings the apparent image closer.

TRANSIENT - A sudden burst of energy in an audio signal which only lasts for a small period of time relative tc the rest of the signal. The level of these transients can often reach 10 times or so the normal operating level of the audio equipment, and may cause distortion.

VIRTUAL POINT SOURCE - The point in space at which the axes of the speakers in an array cross. This will be the point from which the sound appears to originate.

FIGURES

1: Clipping waveform

2: XLR connections

3: Daisy-chaining cabinets

4: Off-axis comb filtering. Mid and high frequencies

5: Reinforcement of bass frequencies

6: Virtual point-source and two examples of possible system configurations

7: Vertical angling of stacked array

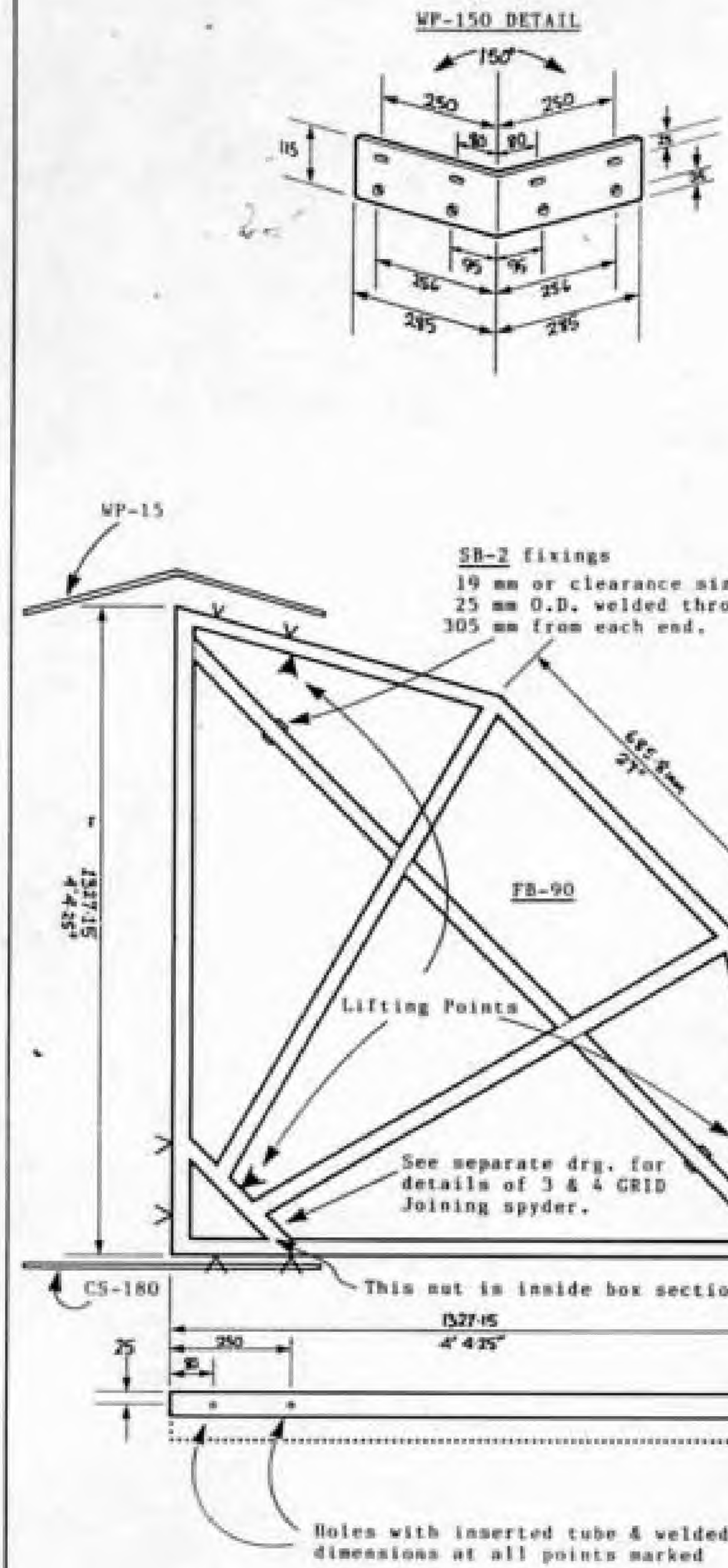
8: Flown TSE-111 showing quicklink

9: Flown TSE cluster (sectional view)

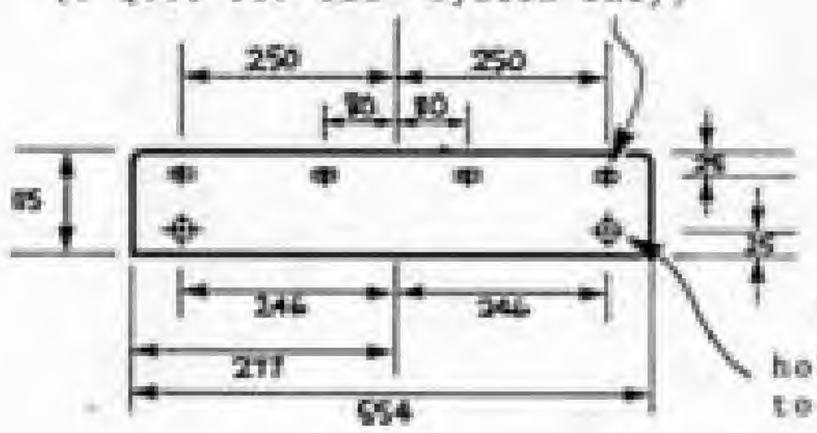
10: Flown TSE cluster (plan view)

11: Bass enclosure stabiliser

12: Photograph of the TSE Installation System at Portsmouth Guildhall

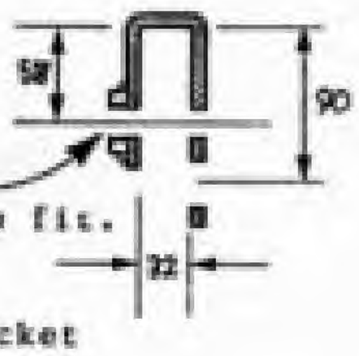

WP-150 DETAIL
150°
250
250
80
80
115
25
35
95
95
382
254
285
285
WP-15
SB-2 fixings
19 mm or clearance size I.D. tube
25 mm O.D. welded through box section
305 mm from each end.
FB-90
Lifting Points
See separate drg. for details of 3 & 4 GRID Joining spyder.
Strengthening bar is under main grid
CS-180
This nut is inside box section 'B'
1527.15
4' 4.35"
250
80
25
50
Holes with inserted tube & welded nuts at these dimensions at all points marked

CS-180 DETAIL
Flat Joining Plate
(1 QTY. for 180° system only)



HC-18
Has hole to fit pin on CB-3
(3 QTY. for each FB-90)

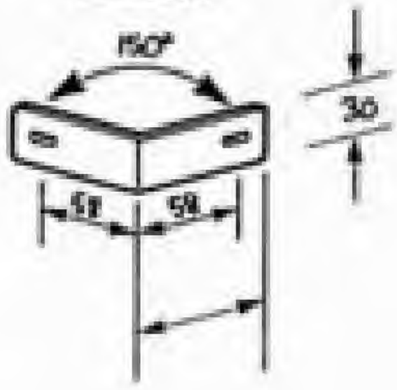
CB-3
SWL 3.1 Tonnes
at 45° to vert.
(1 QTY. for each 90° GRID)

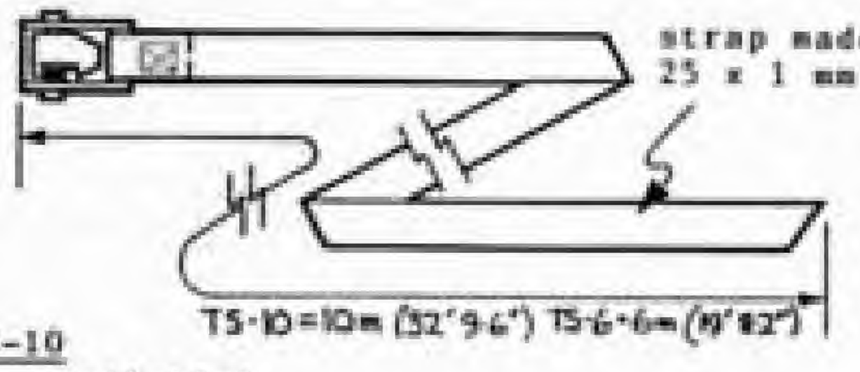


M12 NUT
welded to
bracket
with Bolt to fit.

Box Hanging Bracket
has 25 mm Dia.
hole to take
Kwiklinks
(2 QTY. for each
vertical row of
cabinets.)

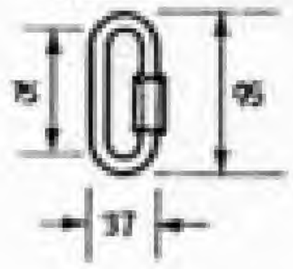
BB-118

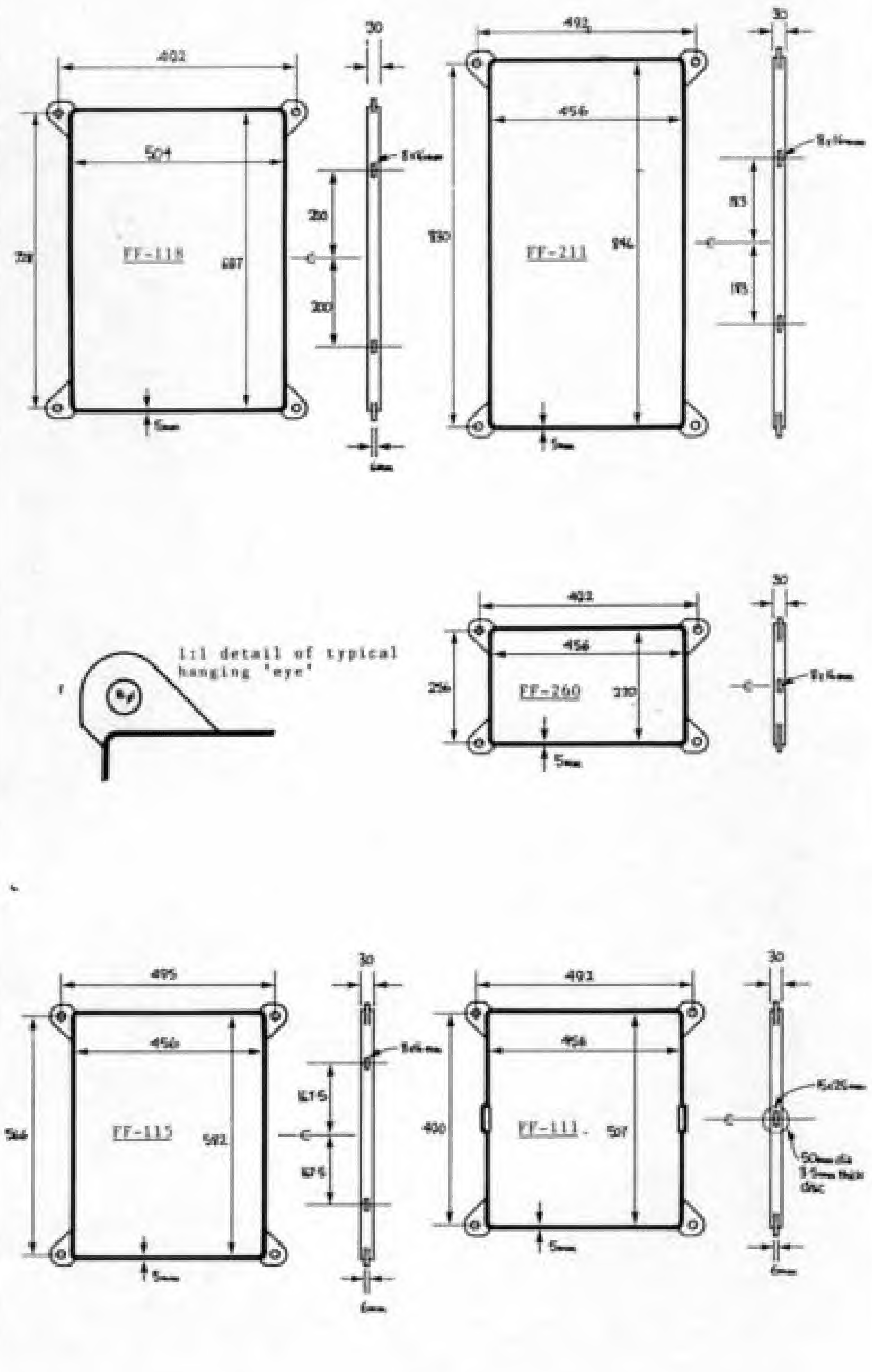




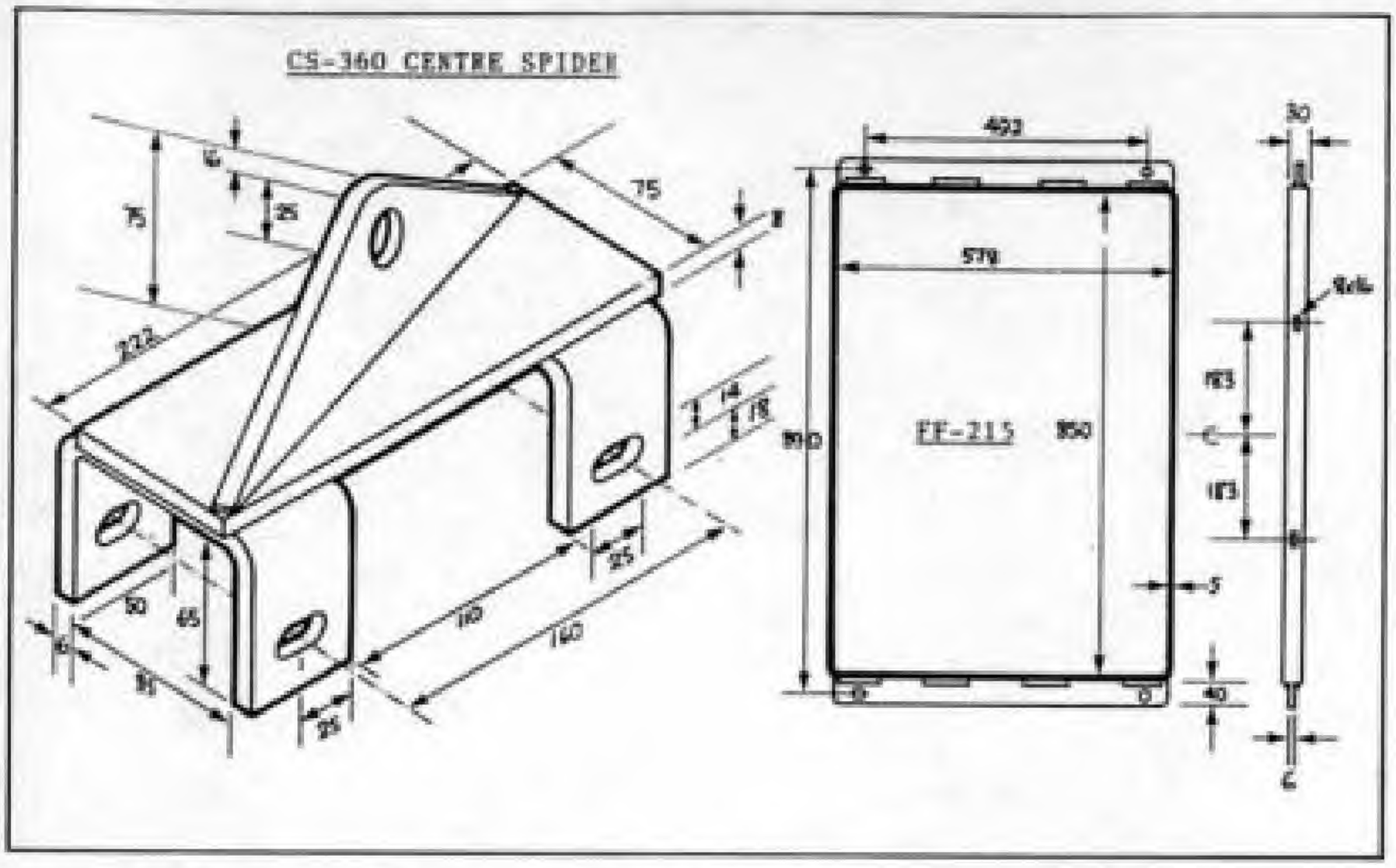
TS-10
(TS-6 also available)

QL-75





FF-118
504
687
5mm
6mm
30
FF-211
456
5mm
30
1:1 detail of typical
hanging 'eye'
FF-260
456
5mm
30
FF-115
495
456
5mm
6mm
30
FF-111
491
456
430
5mm
6mm
30
50mm dia



TSE SERIES OPTIONS AND ACCESSORIES

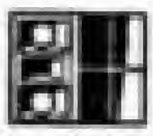
Flying and Lifting Hardware

MODEL	DESCRIPTION
PA-111	TSE-111 pole assembly
FY-111	TSE-111 flying yoke
FF-260	TSE-260 flying frame
FF-111	TSE-111 flying frame
FF-211	TSE-211 flying frame
FF-115	TSE-115 flying frame
FF-215	TSE-215 flying frame
FF-118	TSE-118 flying frame
FB-90	90o quadrant section
CB-3	3-leg chain bridle
SB-2	2-leg safety bridle
HC-18	Hanging clamp
EC-25	Enclosure clamp
WP-15	15o wing-plate extension
CS-180	180o center spider
CS-270	270o center spider
CS-360	360o center spider
QL-75	75mm quicklink
TS-6	6m tilting strap
TS-10	10m tilting strap
CL-260	Chain link-260 height
CL-111	Chain link-111 height
CL-211	Chain link-211 height
CL-115	Chain link-115 height
CL-215	Chain link-215 height
CL-118	Chain link-118 height
BB-118	Bracing bracket for TSE-118/215
FB-90C	1x FB-90, 1x CB-3, 1x SB-2, 3x HC-18, 6x EC-25, 2x WP-15
FB-180C	2x FB-90, 2x CB-3, 2x SB-2, 6x HC-18, 10x EC-25, 3x WP-15, 1x CS-180
FB-270C	3x FB-90, 3x CB-3, 3x SB-2; 9x HC-18, 15x EC-25, 4x WP-15 1x CS-270
FB-360C	4x FB-90, 4x CB-3, 4x SB-2; 12x HC-18, 20x EC-25, 4x WP-15 1x CS-360

THE TURBOSOUND RANGE

TMS-1 – Full-range enclosure • passive 3-way • 250 Watts RMS • Frequency response 90Hz-17kHz +/– 3dB • Dispersion 70°H x 70°V at – 6dB Points 610mm H x 432mm W x 451mm D.

TMS-2 – Full-range enclosure • bi-amped 3-way (XPX-2 passive module available) • 400 Watts RMS • Frequency response 65Hz-18kHz +/– 3dB • Dispersion 70°H x 70°V at –6dB Points 865mm H x 432mm W x 578mm D.



TMS-3 – Full-range enclosure • tri-amped 3-way • 800 Watts RMS • Frequency response 55Hz – 20kHz +/– 4dB • Dispersion 70°H x 50°V at – 6dB Points 844mm H x 1019mm W x 578mm D.

TMS-4 – Full-range enclosure • bi-amped 3-way • 450 Watts RMS • Frequency response 43Hz – 18kHz +/– 3dB • Dispersion 70°H x 60°V at –6dB Points 1143mm H x 502mm W x 730mm D.

TSE-260 – High frequency enclosure • 100 Watts RMS • Frequency response 2kHz – 20kHz +/– 4dB 267mm H x 451mm W x 480mm D.

TSE-111 – Mid-high enclosure • passive 2-way • 150 Watts RMS • Frequency response 250Hz – 18kHz +/– 3dB 503mm H x 453mm W x 487mm D.

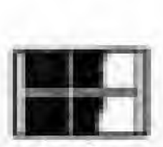
TSE-211 – Mid-high enclosure • switchable bi-amped /passive 2-way • 300 Watts RMS • Frequency response 250Hz – 20kHz +/– 4dB 842mm H x 450mm W x 481mm D.

TSE-115 – Bass enclosure • 250 Watts RMS • Frequency response 65Hz – 500Hz +/– 3dB 578mm H x 430mm W x 578mm D.

TSE-215 – Bass enclosure • 500 Watts RMS • Frequency response 60Hz – 500Hz +/– 3dB 575mm H x 844mm W x 578mm D.

TSE-118 – Bass enclosure • 300 Watts RMS • Frequency response 45Hz – 350Hz +/– 3dB 685mm H x 503mm W x 721mm D.

TSE-218 – Bass enclosure • 600 Watts RMS • Frequency response 40Hz – 350Hz +/– 3dB 685mm H x 988mm W x 721mm D.



TSW-124 – Sub-bass enclosure • 600 Watts RMS • Frequency response 35-300 Hz +/– 3dB 660mm H x 1019mm W x 1010mm D.

TFM-2 – High-projection floor monitor • bi-amped 3-way • 450 Watts RMS • Frequency response 60Hz – 18kHz +/– 4dB 573mm H x 505mm W x 845mm

TMW-212 – Low-profile floor monitor • passive 2-way • 300 Watts RMS • Frequency response 110Hz – 18kHz +/– 3dB 308mm H x 695mm W x 416mm D.

TMW-215 – Low-profile floor monitor • switchable bi-amped /passive 2-way • 450 Watts RMS • Frequency response 90Hz – 17kHz +/– 3dB 378mm H x 894mm W x 542mm D.

TPC-1151 Phase Checker System
Full range of load tested flying and lifting hardware available for TMS and TSE Series

Turbosound
ONCE HEARD NEVER FORGOTTEN

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